Space Weather Technical Forecast

Issued on Friday, 18 August 2023 at 12:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of isolated M-flares (R1 Blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with occasional C-class flares. Peak flare of C5.1 at 17/1240 UTC from AR3397, which has since rotated across the western limb. There are currently eight regions on the visible disc. AR3403, in the northwest, remains the largest region on the disc and one of the more complex but has remained relatively stable. Nearby AR3409 continues to grow meridionally, with a number of spots developing in recent hours. AR3405 in the northeast has relatively remained unchanged and appears simple, however a filament across the region adds a layer of complexity and uncertainty.

No Earth-directed CMEs were detected in available imagery, with observed ejecta from western limb events.

Solar Wind / Geomagnetic Activity: A transition into a CIR (co-rotating interaction region) was observed around 17/1900 UTC before connection to the HSS from CH35/- occurred around 18/0200 UTC. Speeds were initially at slow-ambient levels, around 320 km/s before increasing sharply around 18/0200 UTC to 420km/s and have since fluctuated between 420-500km/s. Density was initially below average soon increasing to above average, peaking around 15ppcc, density then returned to below average levels around 18/0200 UTC where it has largely remained. The total interplanetary magnetic field strength (IMF), Bt, was generally weak at 5-8nT, but increasingly erratic and strengthening after 17/1600 UTC, reaching moderate levels, with a peak of 15nT at 18/0209 UTC. The north-south component was initially weakly negative, but became predominately moderately positive from 17/1630 UTC, peaking +11nT. Since 17/2350 UTC the north-south component has fluctuated markedly between -12nT/+10nT, with no prolonged period either positive or negative. Phi angle was initially positive (away from the Sun) but became negative (towards the Sun) from 17/1900 UTC. Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at background. GOES16 high energy (greater than 2MeV) electron flux persisted largely at background levels, with the associated 24 hour fluence declining sharply at the start of the period and is now on a very slow rise, but remains well below the Active level. The observed fluence at 18/0000 UTC was 1.33e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is likely, but with a chance of rising to Moderate with isolated M-flares possible. This risk is expected to increase slightly towards the end of the period, given the potential for one or more active region to rotate onto the disc Day 2 (19 Aug) or Day 3 (20 Aug).

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently expected. The ongoing enhancement to solar winds (450-500 km/s) associated with the influence of negative CH35 is expected to wane later Day 1 (18 Aug) or Day 2. Winds are then expected to gradually return to slow-ambient levels. Quiet (Kp0-2) to Unsettled (Kp3) geomagnetic activity at first, with

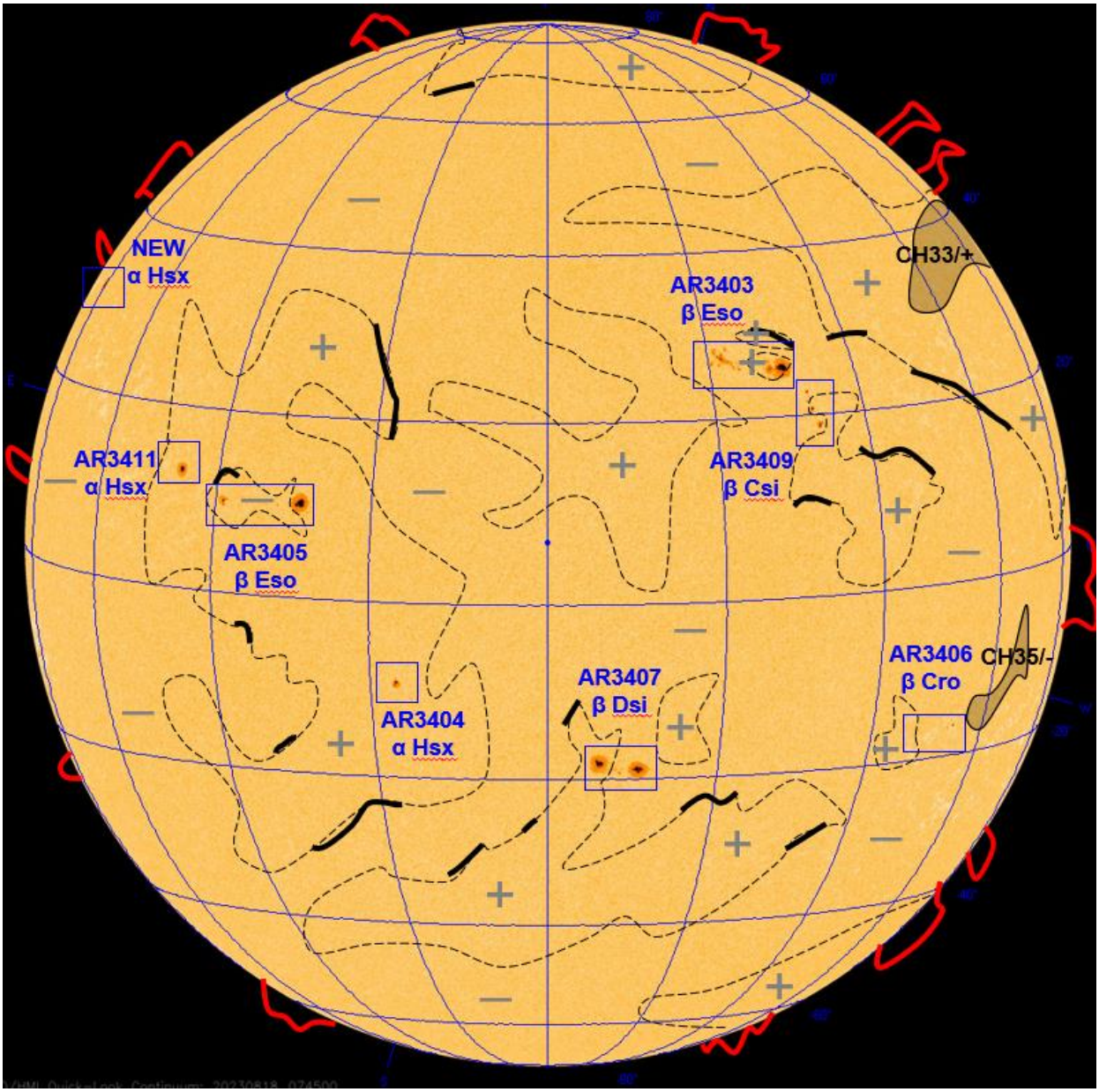
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

a slight chance of Active intervals. This risk passes later Day 1, with mainly Quiet activity and a decreasing chance of Unsettled intervals through the remainder of the period.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at background. High energy electron flux (greater than 2MeV) remains predominantly at background levels with only a weak enhancement expected from the current fast wind connection. No further enhancements are forecast so electron flux levels are expected to remain mostly at background, increasing to Moderate at diurnal maximum. The associated 24 hr fluence is expected to persist below Active (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 18/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Geomagnetic Storms:

There are currently no Earth-directed CMEs.

The recent enhancement to the IMF (interplanetary magnetic field) is likely to be the result of a weak connection to the HSS from CH35/- in the far southwest disc, close to the western limb. This is a reasonably small feature, with slightly elevated or elevated winds expected to ease later Day 1 (18 Aug), perhaps persisting into early Day 2 (19 Aug). Winds are expected to return to slow-ambient levels by Day 3 (20 Aug). No further significant enhancements are expected through the period. This is supported by Enlil which is thought to be giving a good steer for the forecast period.

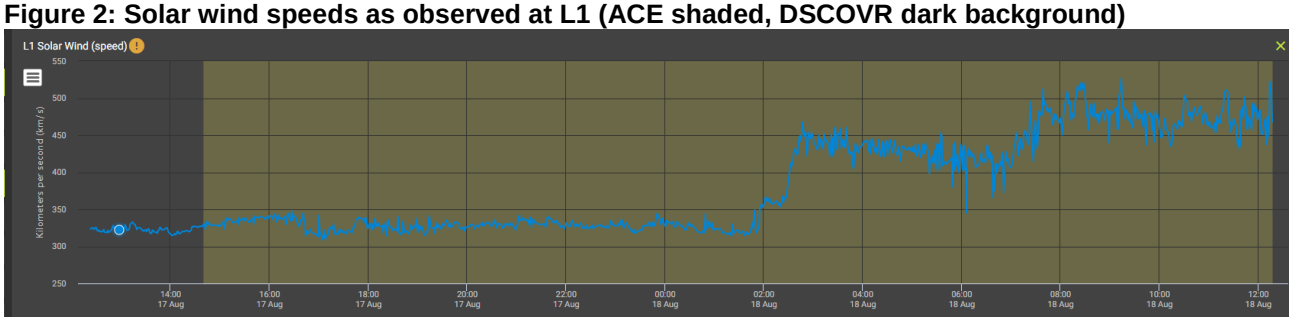
Geomagnetic activity is forecast to be Quiet (Kp0-2) to Unsettled (Kp3) at first, with a chance of an isolated Active (Kp4) interval on Day 1. This risk will diminish by Day 2, with a return to mainly Quiet conditions, with a decreasing chance of further Unsettled spells.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

There are no Earth-directed CMEs currently expected.

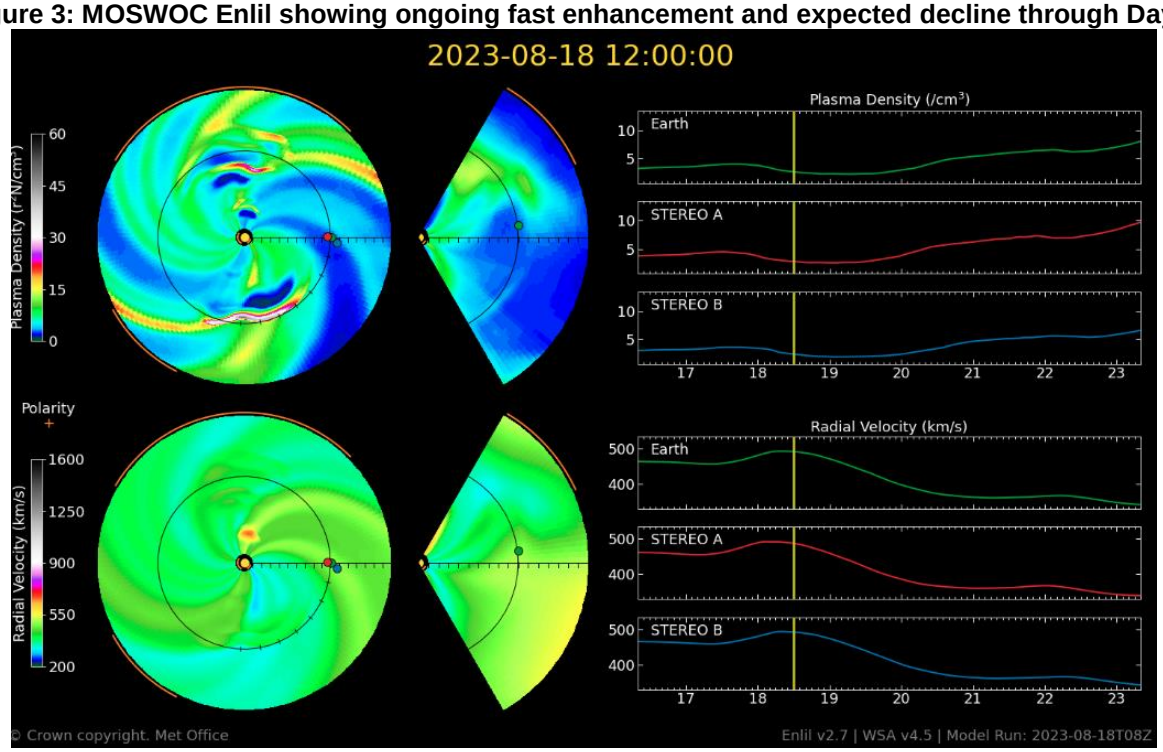
Figure 2: Solar wind speeds as observed at L1 (ACE shaded, DSCOVR dark background)



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Figure 3: MOSWOC Enlil showing ongoing fast enhancement and expected decline through Day 2.



Radio Blackouts - X-Ray Flares:

Low solar activity is expected to persist, with a chance of rising to Moderate due to isolated M-flares.

There are currently eight sunspot regions on the visible disc. Several of the regions are stable unipolar spots, including one region which has recently rotated onto the disc. AR3407 (Dsi/Beta), close to the south-centre, although one of the larger regions on the disc has seen little change or flare activity. Two of the more complex regions on the disc are AR3403 (Eso/Beta) and nearby AR3409 (Csi/Beta). AR3409, a narrow N-S oriented region in the northwest of the disc, has seen a number of spots develop over the past few hours, which have already developed penumbras. AR3405 (Eso/Beta), remains relatively unchanged and simple in appearance on available imagery. However, SDO imagery suggests that a nearby filament may be attached to the group, complicating its magnetic structure and could yet be a source of flare activity.

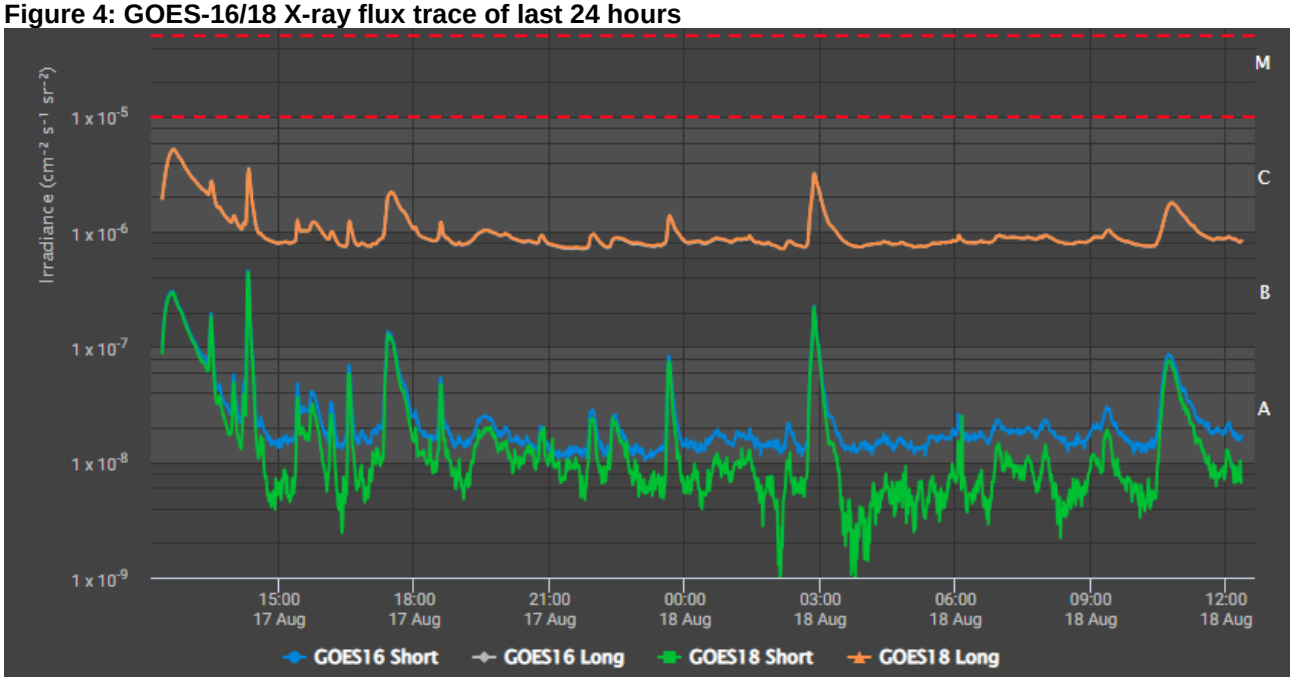
Far-sided tools show the potential for one or more notable sunspot regions to return across the eastern limb Day 2-3 (19-20 Aug) which results in a slight uptick in M-flare probabilities later in the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	40	40
Very Active	R3 to R5 X Class	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Figure 4: GOES-16/18 X-ray flux trace of last 24 hours



Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux observed by GOES-16 is expected to remain at background levels. There persists a small chance of slight increases from any significant flares, predominately from the western hemisphere or over the limb, however this is unlikely to reach S1 Minor Storm.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is at background levels and is expected to remain at this level throughout with only minor enhancement Days 2-3 (19-20 Aug) following the recent arrival of the HSS. There is a chance of rising to Moderate at periods of diurnal maximum, mainly Days 2-4 (19-21 Aug).

The associated 24 hour fluence is expected to remain well below the Active threshold, as supported by REFM which is currently considered to be giving good guidance.

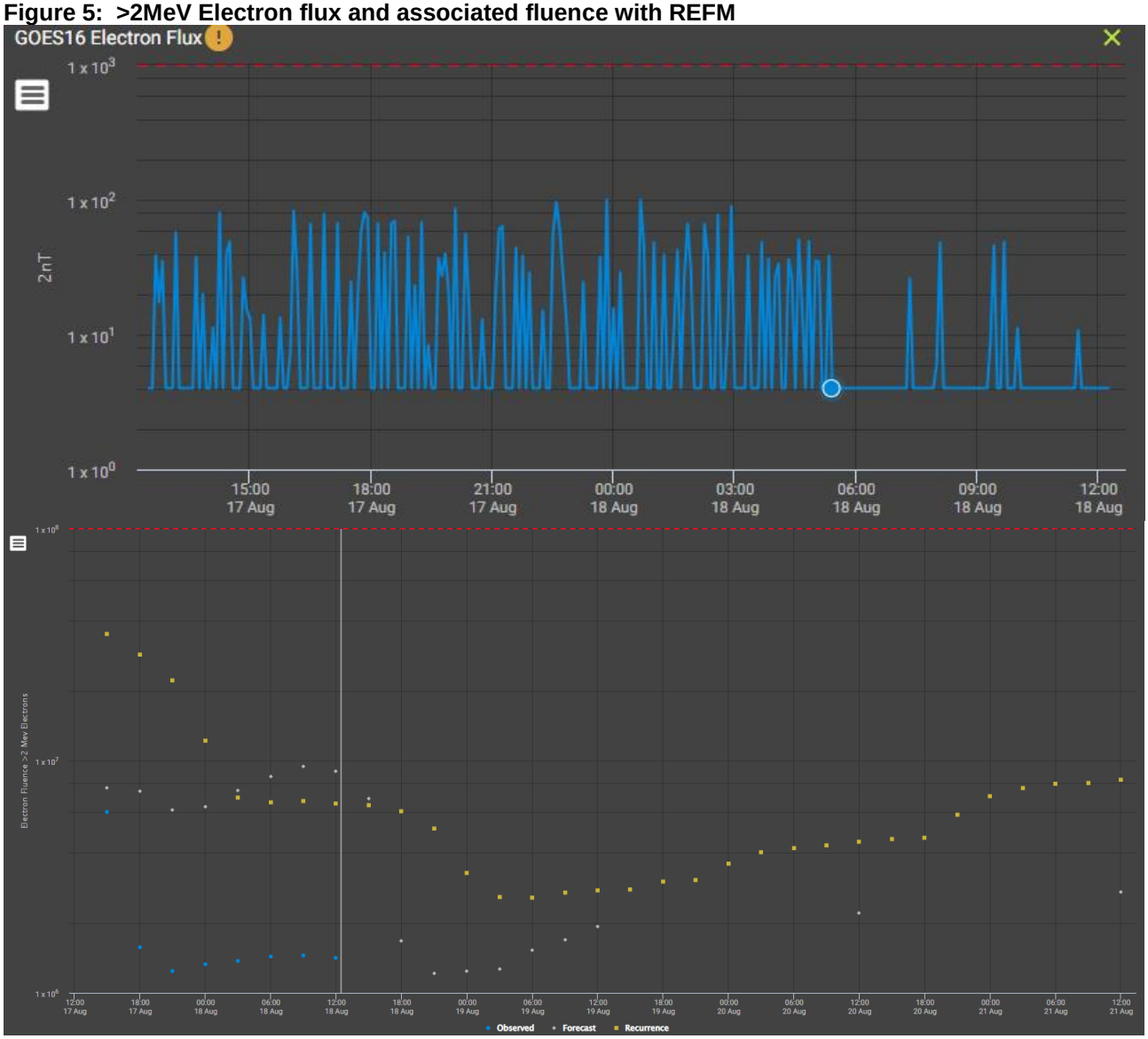
GEO Electron Environment	Level (cm^{-2} sr^{-1}	Past 24 Hours	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Probability (Exceedance)	day^{-1})	(Yes/No)	(%)	(%)	(%)	(%)
Active	**≥ 2 MeV ≥ 1x10^{8}**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ 1x10^{9}**	No	1	1	1	1

Figure 5: >2MeV Electron flux and associated fluence with REFM



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.